भारतीय मानक
Indian Standard

IS 16982 : 2018

ताप द्वारा मजबुत काँच — विशिष्टि

Heat Strengthened Glass — Specification

ICS 81.040.20

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भारतीय मानक ब्यूरो
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June 2018 Price Group 3

Glass, Glassware and Laboratoryware Sectional Committee, CHD 10

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Glass, Glassware and Laboratoryware Sectional Committee had been approved by the Chemical Division Council.

Heat strengthened glass is produced by the heating and gradual cooling of float glass in a controlled environment. It has a higher resistance to thermal stress and enhanced mechanical strength when compared to annealed glass. Heat strengthened glass is not considered as a safety glazing material, as it leads to jagged edges on breakage. It finds application in façade glazing, as a base material for laminated glass etc.

In the formulation of this standard, considerable assistance has been derived from the following publication.

Standard	*Title*
BS EN 1863-1 : 2011	Glass in building — Heat strengthened soda lime silicate glass: Part 1 Definition and description

The composition of the technical committee responsible for formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

HEAT STRENGTHENED GLASS — SPECIFICATION

1 SCOPE

This standard prescribes the requirements, method of sampling and test for heat strengthened glass meant for use in architectural buildings and general purposes. This standard does not cover surface finished glasses (sandblasted, acid etched etc., after heat strengthening).

NOTE — Heat strengthened glass is not a safety glass.

2 REFERENCES

The standards listed below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

IS No.	*Title*
1382 : 1981	Glossary of terms related to glass and glassware (*first revision*)
2553 (Part 1) : 2018	Safety glass — Specification: Part 1 Architectural, building and general uses (*fourth revision*)
14900 : 2018	Transparent float glass — Specification (*first revision*)
17004 : 2018	Testing methods for processed glass

3 TERMINOLOGY

For the purpose of this standard, the definitions given in IS 1382 and IS 2553 (Part 1) shall apply in addition to the following.

3.1 Ceramic Fritted (Enamelled) Heat Strengthened Glass

Heat strengthened glass which has a ceramic frit fired into the surface during the heat treatment process. After heat treatment, the ceramic frit becomes an integral part of the glass.

3.2 Heat Strengthened Glass

A single piece of glass within which a permanent surface compressive stress, additionally to the basic mechanical strength, has been induced by a controlled heating and cooling process in order to give it increased resistance to mechanical and thermal stress and prescribed fracture characteristics (*see* **6.1.5** of IS 17004).

3.3 Horizontal Heat Strengthening

Process in which the glass is supported on horizontal rollers when it is undergoing the heat strengthening process.

3.4 Vertical Heat Strengthening

Process in which the glass is suspended by tongs when it is undergoing the heat strengthening process.

4 REQUIREMENTS OF HEAT STRENGTHENED GLASS

4.1 Material

Heat strengthened glass may be flat or curved and can be clear/tinted/coated as agreed to between the manufacturer and the purchaser.

4.2 Distribution of Allowable Defects

The allowable defects (spot faults, linear faults, reams, strings, lines, optical faults) in flat glass used in the manufacture of heat strengthened glass shall not exceed the limits specified in **4.4** and **4.5** of IS 14900.

4.3 Thickness

The thickness of heat strengthened glass shall be measured in accordance with the method prescribed in **5.2** of IS 17004. Nominal thickness and range of thickness shall be as specified in Table 2 of IS 14900.

4.4 Dimensions and Squareness

The dimension and squareness of the heat strengthened glass shall be as per **5.2.2.1** and **5.2.2.2** of IS 2553 (Part 1).

4.5 Fragmentation Test or Compressive Stress Measurement

It shall pass the fragmentation test when tested as per **6.1** of IS 17004 or shall have a surface compression between 31 and 52 MPa (4 500 and 7 500 psi) when tested as prescribed in **6.5** of IS 17004.

NOTE 1 — It is recommended that compressive stress measurement be followed with fragmentation for accurate and effective assessment.

NOTE 2 — If the surface compression is above 52 MPa, the fracture characteristic of the glass does not conform to that prescribed in **6.1.5** of IS 17004, and therefore cannot be classified as heat strengthened glass.

4.6 Mechanical Strength (Optional)

When tested as per the method prescribed in **6.3** of IS 17004, the 5 percent breakage probability for heat strengthened glass, statistically evaluated with a minimum of 95 percent confidence level, shall not be less than the values specified in Table 1.

The value of mechanical strength can be expressed as a statistical value associated with a particular probability of breakage and with a particular type of loading.

The mechanical strength values apply to quasi-static loading over a short time, for example, wind loading.

Table 1 Minimum Values for the Mechanical Strength of Heat Strengthened Glass

(*Clause* 4.6)

Sl No.	Type of Glass	Minimum Value for Mechanical Strength, N/mm^2
(1)	(2)	(3)
i)	Float: clear tinted coated	70
ii)	Enamelled Float (based on the enamelled surface in tension)	45
iii)	Others	55

NOTE — The values in Table 1 represent the mechanical strength of heat strengthened glass which meets the requirements of fragmentation test.

4.7 Flatness

Flatness of the heat strengthened glass shall be as per **5.2.4** of IS 2553 (Part 1).

4.8 Fabrication in Glass

Fabrication in heat strengthened glass shall be as per **5.2.8** of IS 2553 (Part 1).

5 PACKING AND MARKING

5.1 Packing

Heat strengthened glass shall be packed as agreed to between the manufacturer and the purchaser.

5.1.1 The packet shall be marked with the following information:

a) Indication of the source of manufacture,
b) Nominal thickness of glass,
c) Code or batch number,
d) Month and year of manufacture, and
e) Type of glass.

5.2 Marking

Each piece of heat strengthened glass shall be marked indelibly and distinctly with the following information:

a) It shall be marked with the word ‘Heat Strengthened’; and
b) Indication of the source and year of manufacture.

5.2.1 *BIS Certification Marking*

Each glass may also be marked with the standard mark.

5.2.1.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standards Act*, 2016 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

6 SAMPLING

Representative samples of the heat strengthened glass shall be drawn as prescribed in Annex A of IS 2553 (Part 1), for testing the requirements prescribed in **4**.

ANNEX A

(*Informative*)

OTHER PHYSICAL CHARACTERISTICS

A-1 OPTICAL DISTORTION

A-1.1 Thermally Heat Strengthened Glass Produced by Vertical Heat Strengthening

The tong marks can produce additional optical distortion, generally in an area of radius 100 mm centred on the tong mark.

A-1.2 Thermally Heat Strengthened Glass Produced by Horizontal Heat Strengthening

While the hot glass is in contact with the rollers during the heat strengthening process, a surface distortion is produced by a reduction in surface flatness, known as ‘roller wave’. Roller wave is generally noticed in reflection. Glass which is thicker than 8 mm can show signs of small imprints on the surface (‘roller pick-up’).

A-2 ANISOTROPY (IRIDESCENCE)

The heat strengthening process produces areas of different stress in the cross section of the glass. These areas of stress produce a bi-refringent effect in the glass, which is visible in polarised light. When heat strengthened glass is viewed in polarised light, the areas of stress show up as coloured zones, sometimes known as “leopard spots”.

Polarised light occurs in normal daylight. The amount of polarised light depends on the weather and the angle of the sun. The bi-refringent effect is more noticeable either at a glancing angle or through polarized spectacles.

Anisotropy is not a defect but a visible effect.

A-3 THERMAL DURABILITY

The mechanical properties of heat strengthened glass are unchanged for continuous service up to 200°C and are unaffected by sub-zero temperatures. Heat strengthened glass is capable of resisting both sudden temperature changes and temperature differentials up to 100°C.

NOTE — This property does not have any relationship to the fire resistance performance.

ANNEX B

(*Foreword*)

COMMITTEE COMPOSITION

Glass, Glassware and Laboratoryware Sectional Committee, CHD 10

Organization	*Representative*
CSIR — Central Glass and Ceramic Research Institute, Kolkata	Dr K. Muraleedharan (***Chairman***)
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Bhabha Atomic Research Centre, Mumbai	Dr (Smt) Madhumita Goswami Dr Purnananda Nandi (*Alternate*)
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United Breweries Group	Shri S. K. Rastogi
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Member Secretary

Shri Sachin S Menon
Scientist 'B' (CHD), BIS

Processed Glass Subcommittee, CHD 10:4

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Xebec Design and Facilities Pvt Ltd	Shri Deepak Gahlowt

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